



REPLACEMENT SHEET

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Reticle schematic

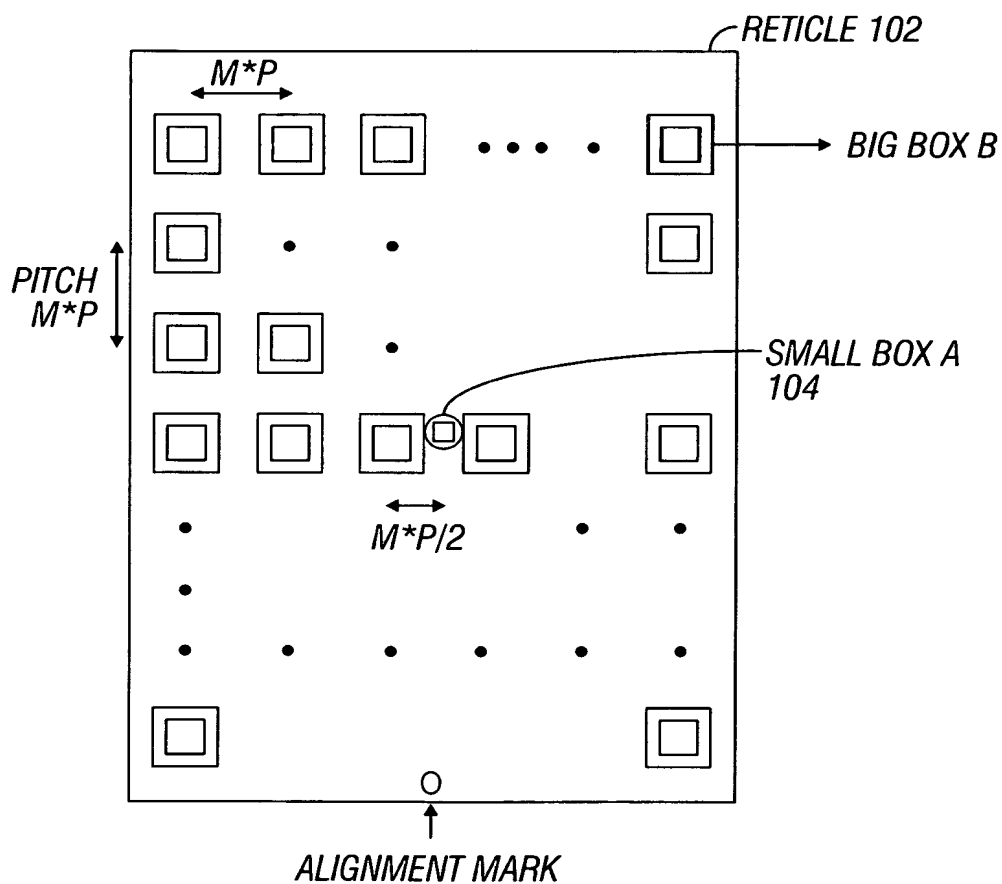


FIG. 1
(Prior Art)

Schematics for FIG. 1

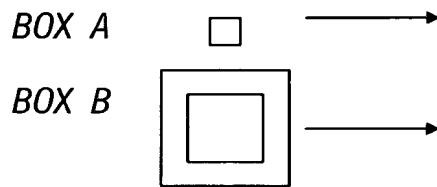


FIG. 2
(Prior Art)

Reticle Features

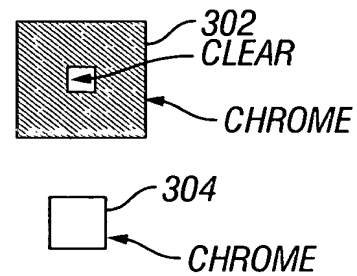


FIG. 3
(Prior Art)

Overlapping regions

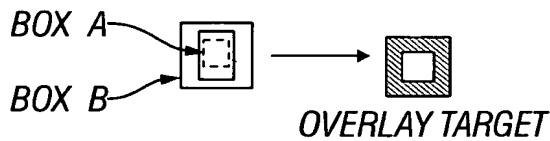


FIG. 4
(Prior Art)

**Perfectly centered
Box-in-Box structure**

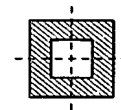


FIG. 4A
(Prior Art)

Schematic for outer box 2



FIG. 5

Outer box 2 as printed on wafer.
Dark=unexposed, white=exposed



FIG. 6

Schematic for inner box 1



FIG. 7

Inner box 1 as printed on wafer.
Dark=unexposed, white=exposed

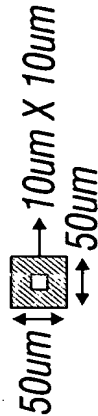


FIG. 8

Schematic for 2-dimensional 4XOL reticle

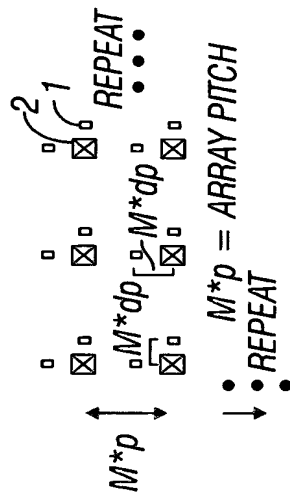


FIG. 9

Typical 4XOL reticle overlay set as projected
onto wafer (3 featured parts); dark=unexposed,
white=exposed

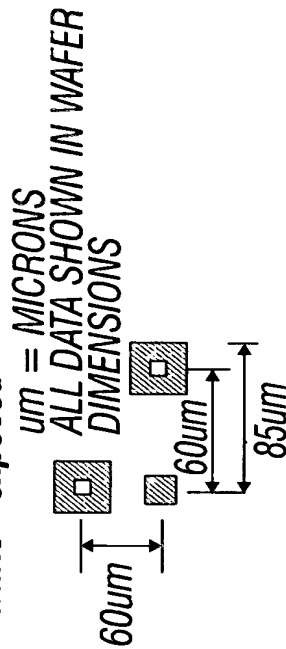


FIG. 10

Schematic of X-shear overlay on wafer

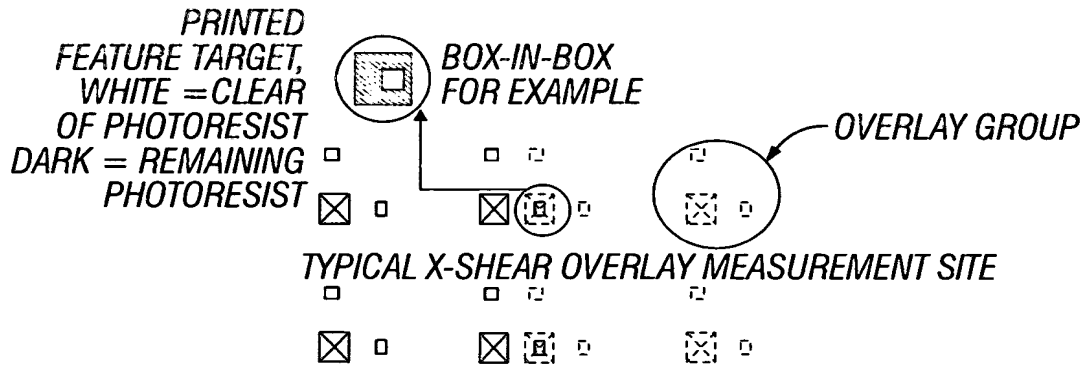


FIG. 11

Schematic of Y-shear overlay on wafer

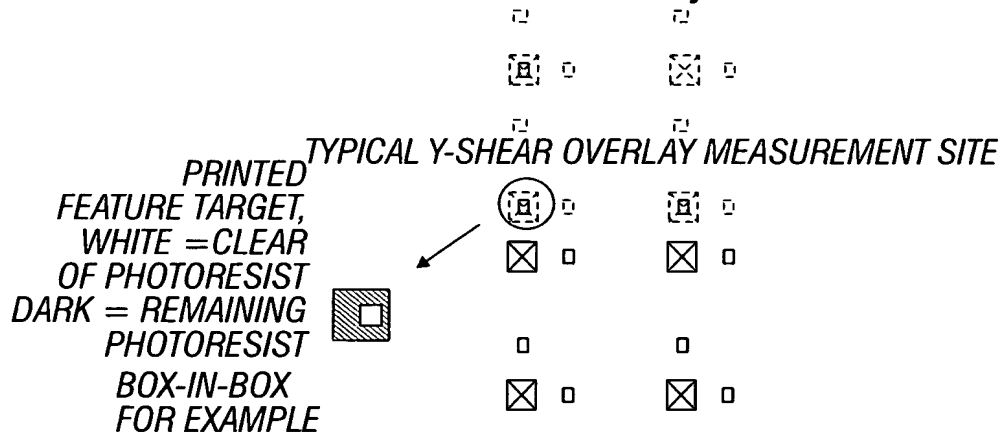


FIG. 12

2-Dimesional reticle schematice, 90 degree overlay or R-shear.

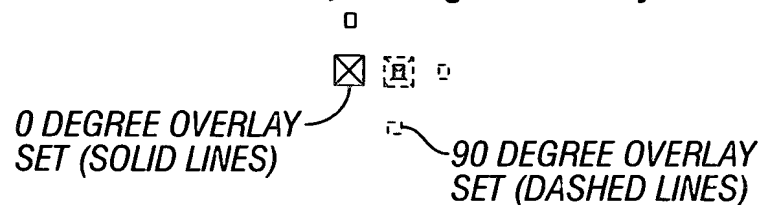


FIG. 13

Typical overlay patterns or completed alignment attributes

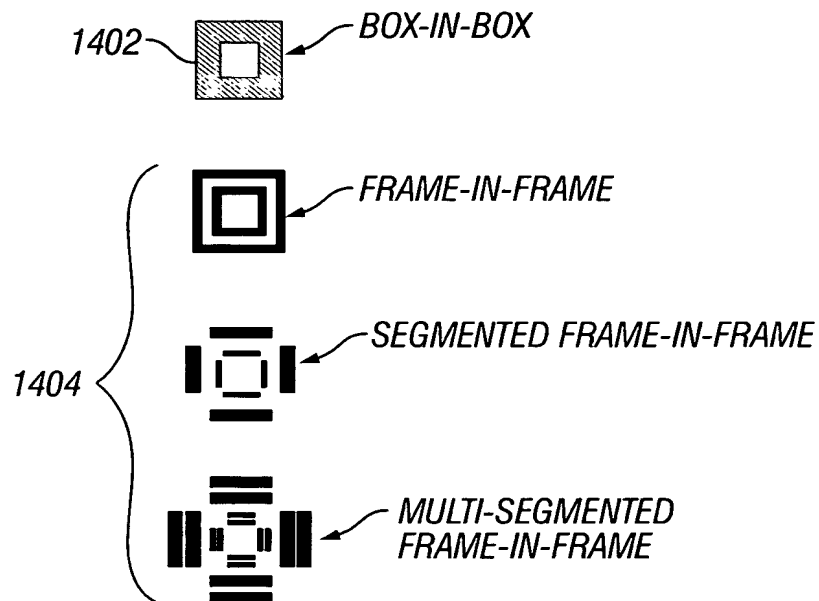


FIG. 14

***Process-flow for the second embodiment for self-referencing
 lens distortion measurement.***

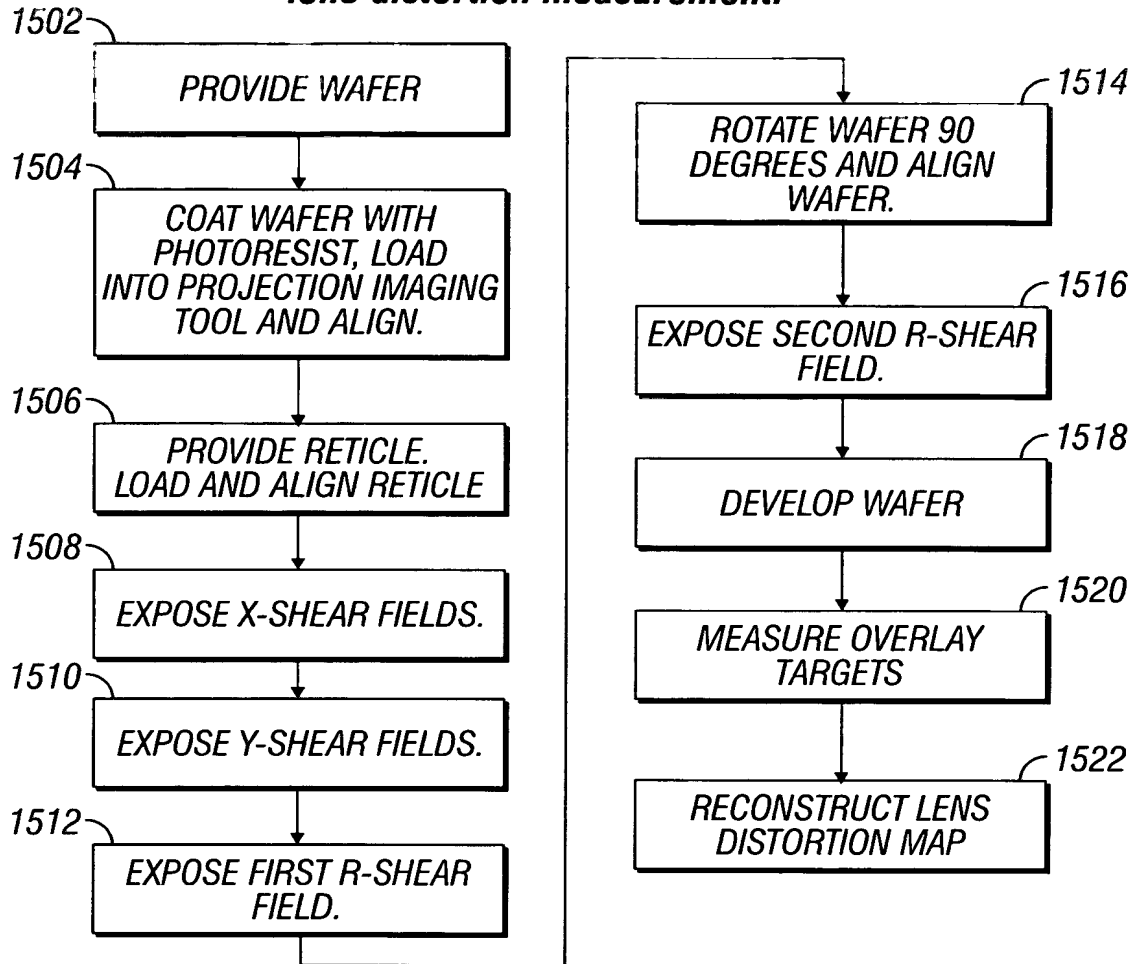


FIG. 15

***Some components of overlay or placement error
 (Inter-field and Intra-field)***



FIG. 16

Photolithographic stepper or scanner system

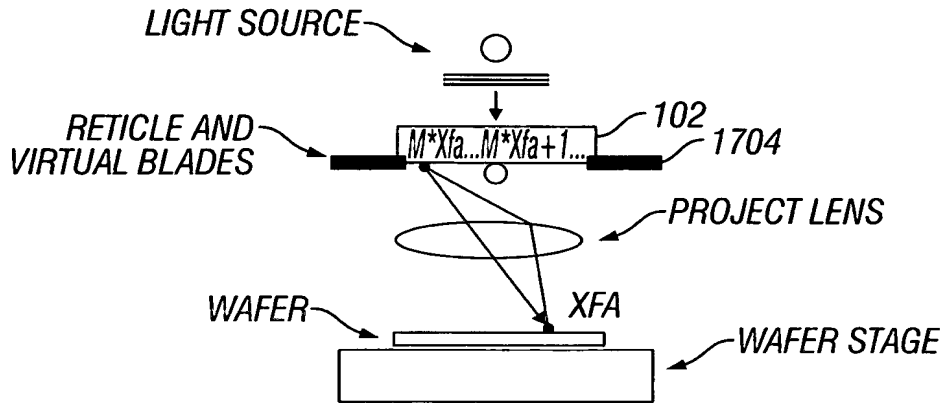


FIG. 17
(Prior Art)

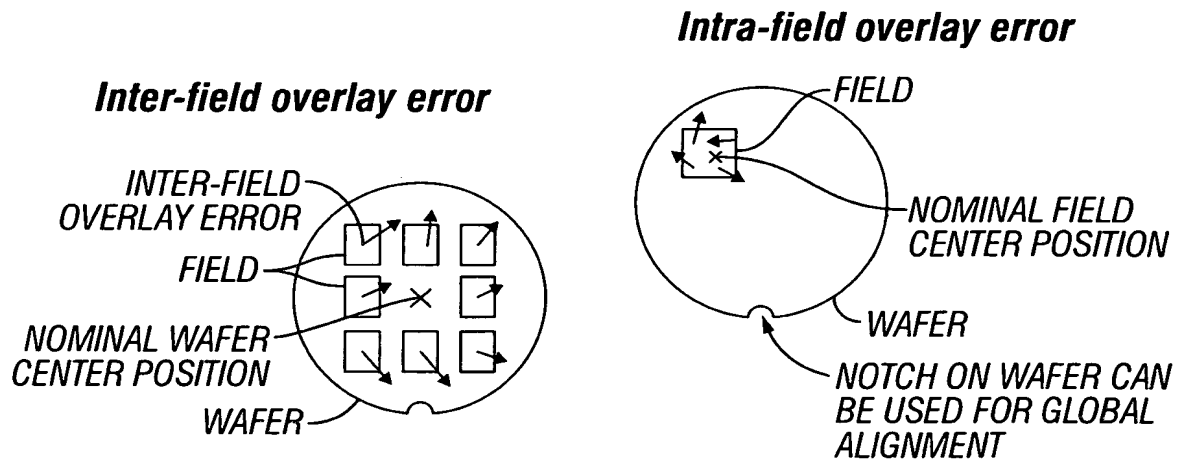


FIG. 18
(Prior Art)

FIG. 19
(Prior Art)

Typical Detail of overlay group on New Overlay
 reticle (FIG. 20) as used on an M=4 lithographic
 projection tool. Dark=chrome, white=open

New Overlay reticle

RETICLE 2002

FIGURE 20A

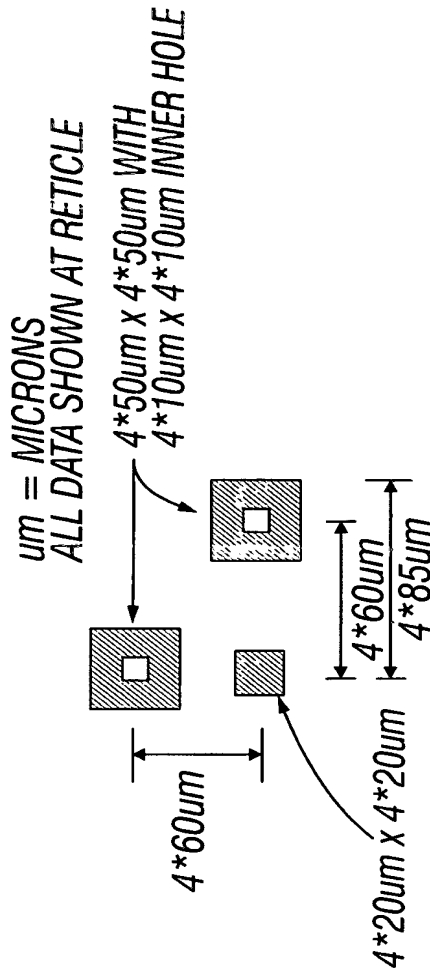
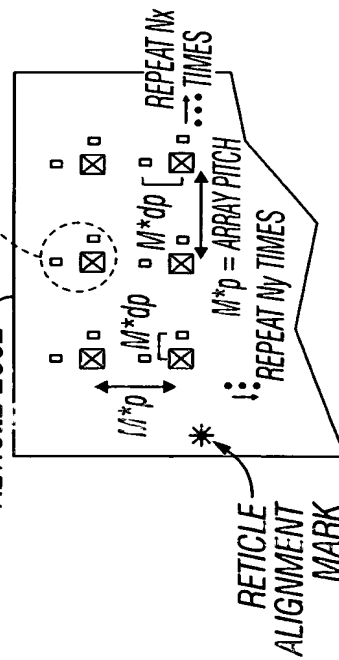


FIG. 20

FIG. 20A

FIG. 20C

Intra-field indices projected onto the wafer

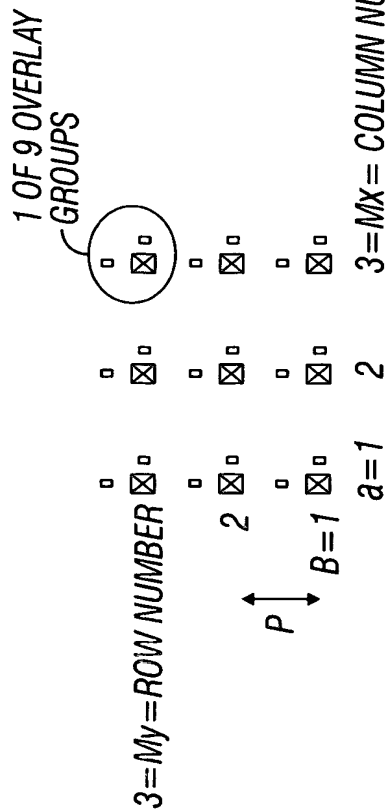


FIG. 20B

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***Example of prior art lens
distortion test***

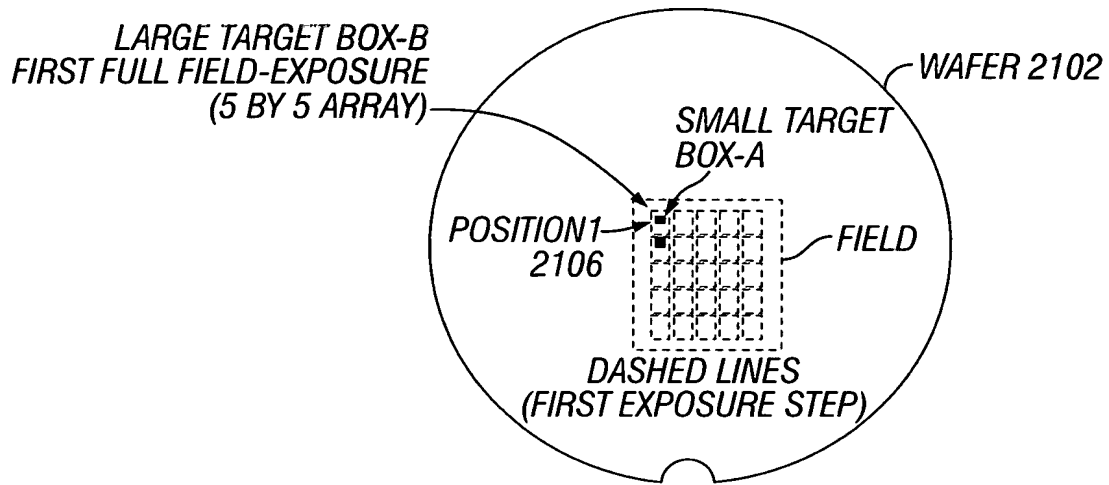


FIG. 21
(Prior Art)

Wafer with alignment marks at 0 and 90 degrees

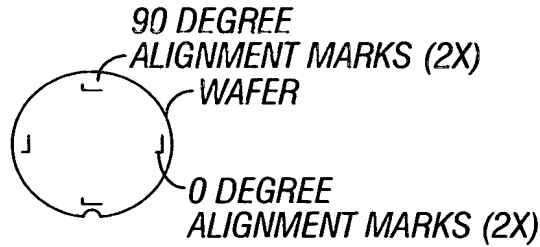


FIG. 22

Wafer after exposure of FIG. 20 overlay reticle at the 0 degree orientation

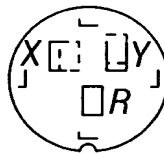


FIG. 23

Wafer after exposure of FIG. 20 overlay reticle at the 0 and 90 degree orientations (clockwise)

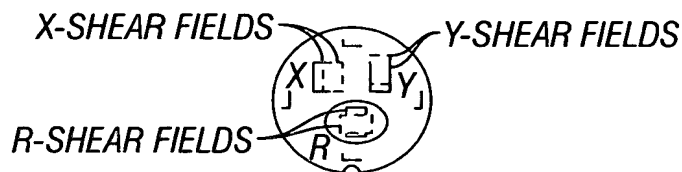


FIG. 24

Detail of R-shear pattern on wafer

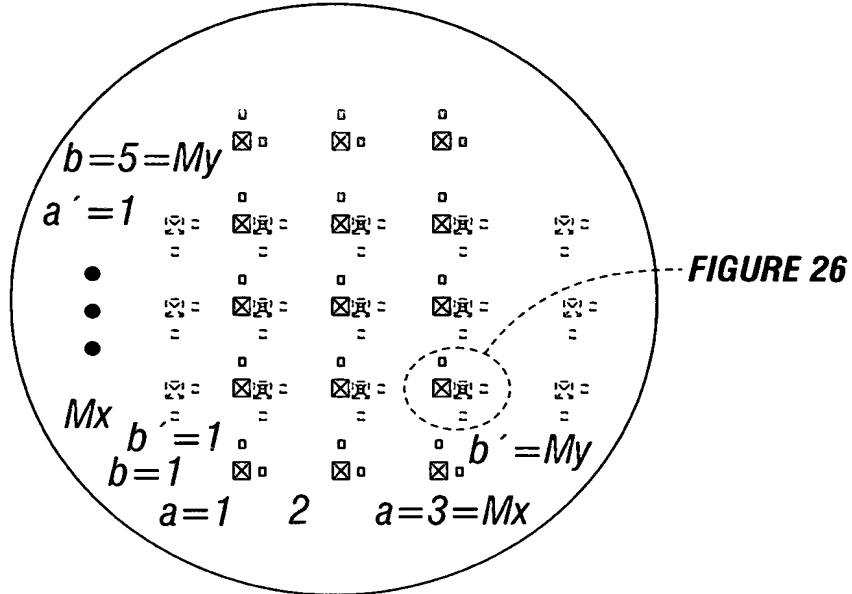


FIG. 25

Closeup of overlay groups for R-shear

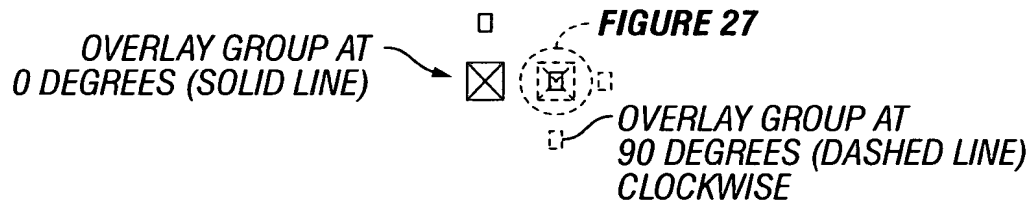


FIG. 26

Single Box-in-Box target.
Dark=undeveloped photoresist
white=no photoresist

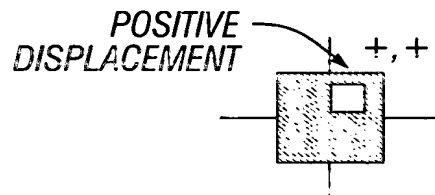
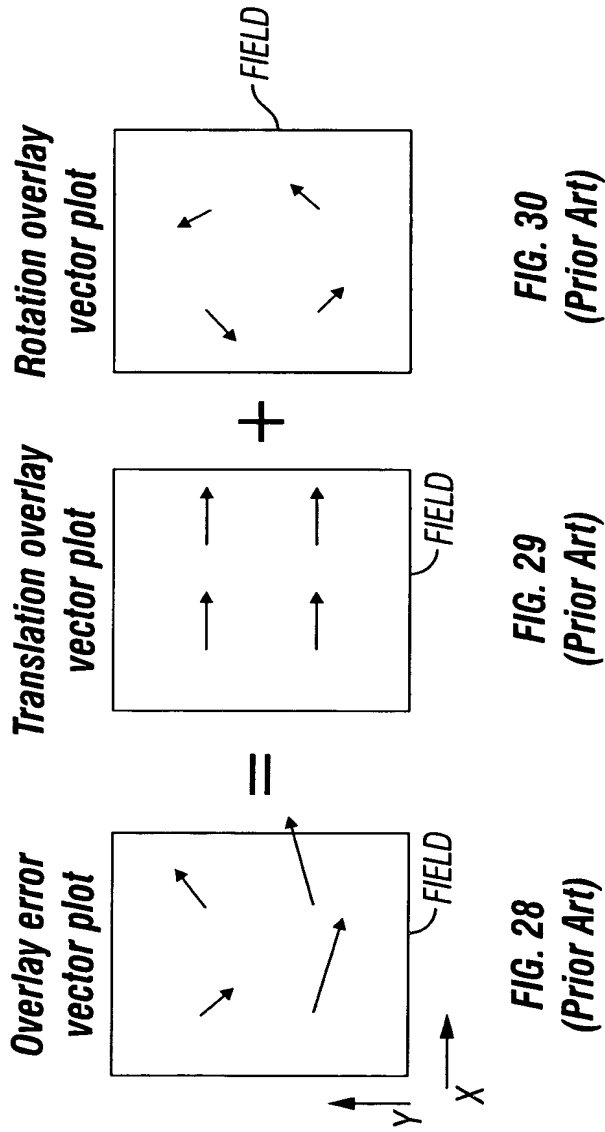


FIG. 27



Overlay measurement

THE VECTOR REPRESENTS THE ALIGNMENT
OFFSET DISTANCE BETWEEN THE BOX-IN-BOX
STRUCTURE

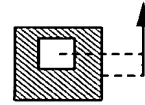


FIG. 31
(Prior Art)

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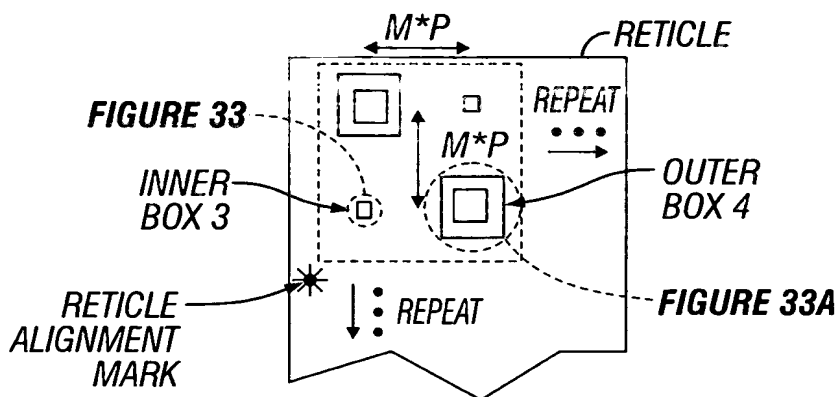


FIG. 32

Inner box 3 on reticle.
Dark=chrome,
white=open.

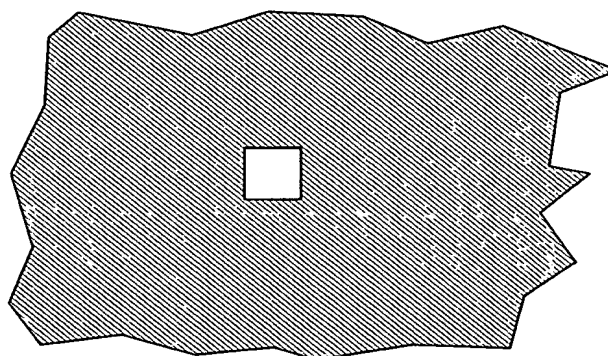
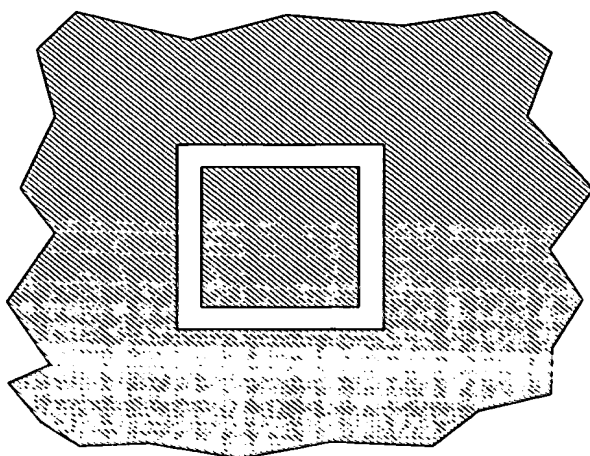


FIG. 33



Outer box 4 on reticle.
Dark=chrome,
white=open.

FIG. 33A

***Process flow for the preferred
embodiment for self-referencing
lens distortion measurement.***

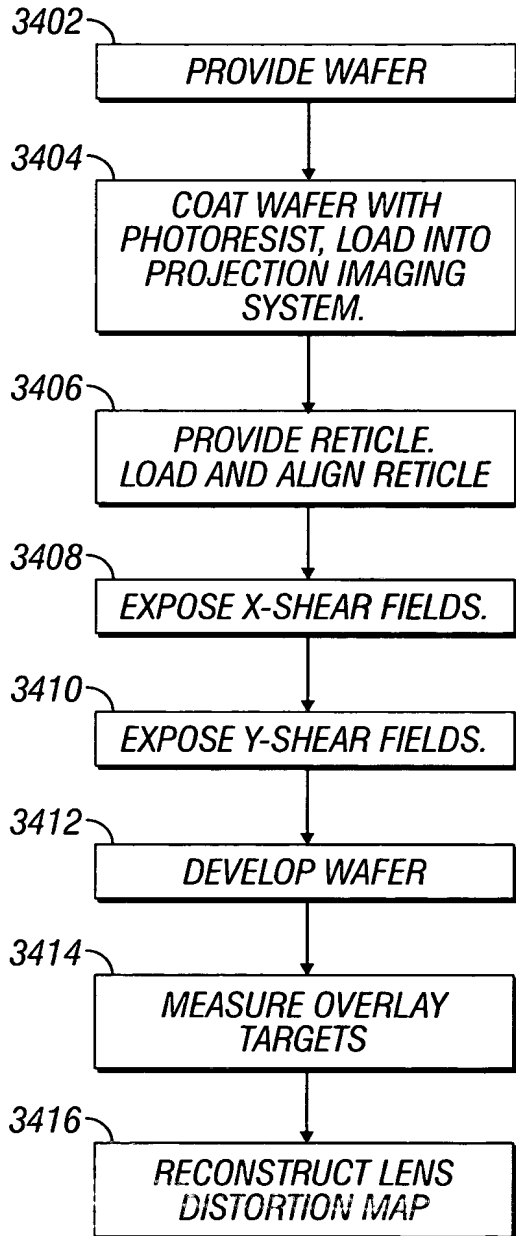


FIG. 34

***Process flow for the alternate
embodiment utilizing sub-Eo
exposure doses on the wafer.***

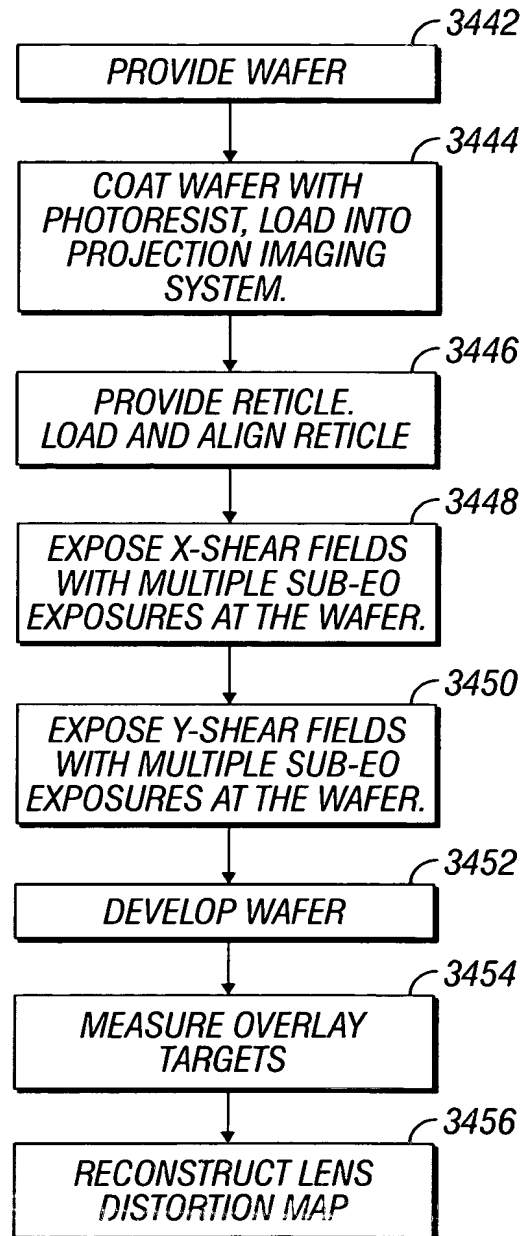
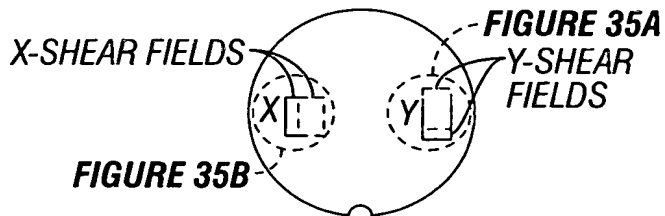


FIG. 34A

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**Wafer after exposure of
 FIG. 20 overlay reticle for
 X and Y shears.**

FIG. 35

**Detail of Y-shear for a 2 x 2
 set of overlay groups**

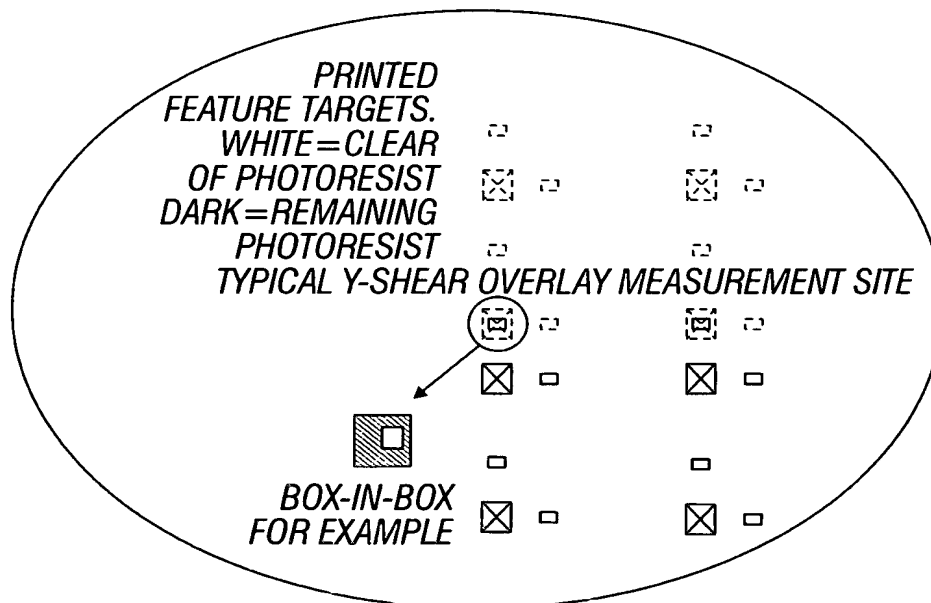


FIG. 35A

DETAIL OF X-SHEAR FOR A 2 x 2
 SET OF OVERLAY GROUPS

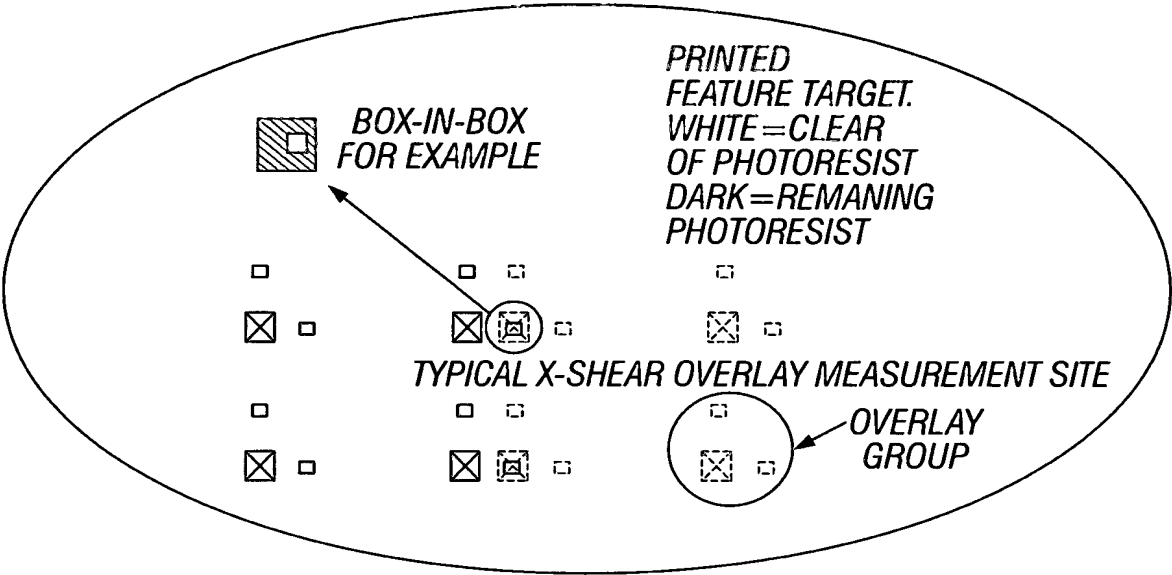


FIG. 35B

FINAL RESULTS OF THE METHOD OF THIS INVENTION.
 UNITS=MICRONS, (xf,yf) = INTRA-FIELD LOCATION,
 (dxf, dyf) = INTRA-FIELD DISTORTION AT POINT (xf, yf).

Machine id: DUVF11-02			
Xf	yf	dxf	dyf
-10000.000	-10000.000	-0.139	0.044
-8000.000	-10000.000	0.223	-0.233
-6000.000	-10000.000	0.498	0.004
⋮	⋮	⋮	⋮
10000.000	10000.000	0.099	-0.188

FIG. 36

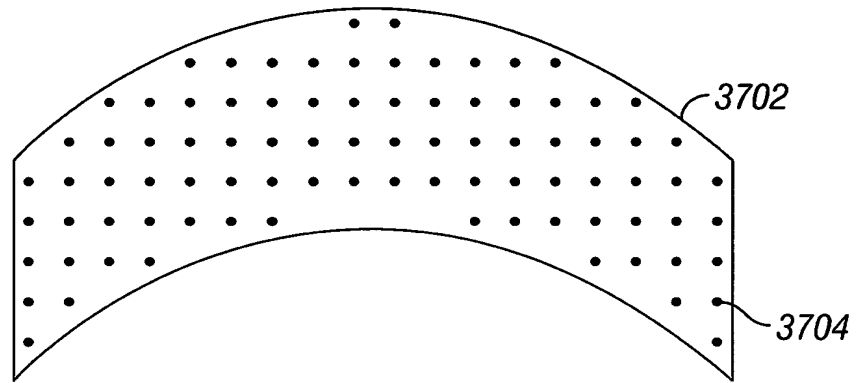


FIG. 37

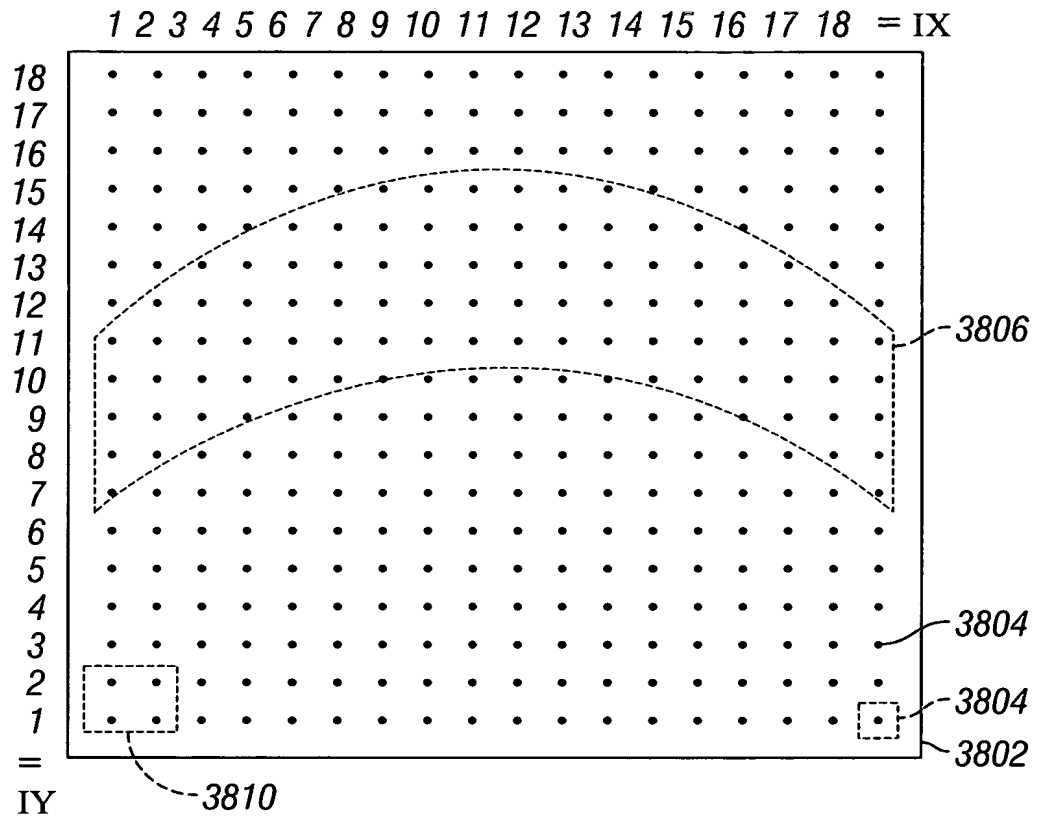


FIG. 38

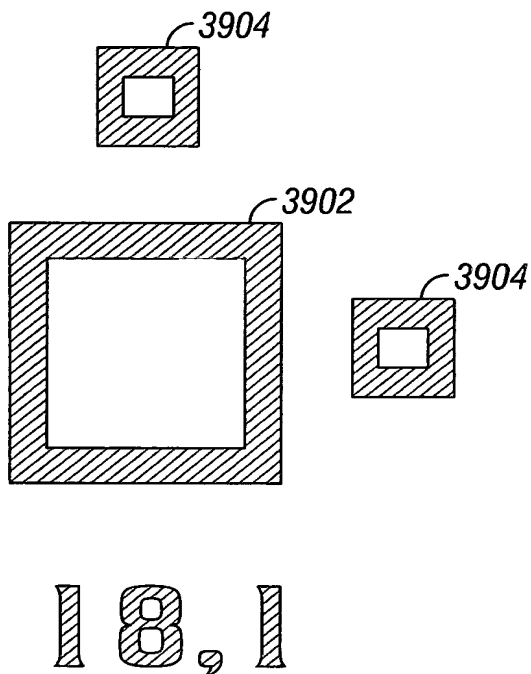


FIG. 39

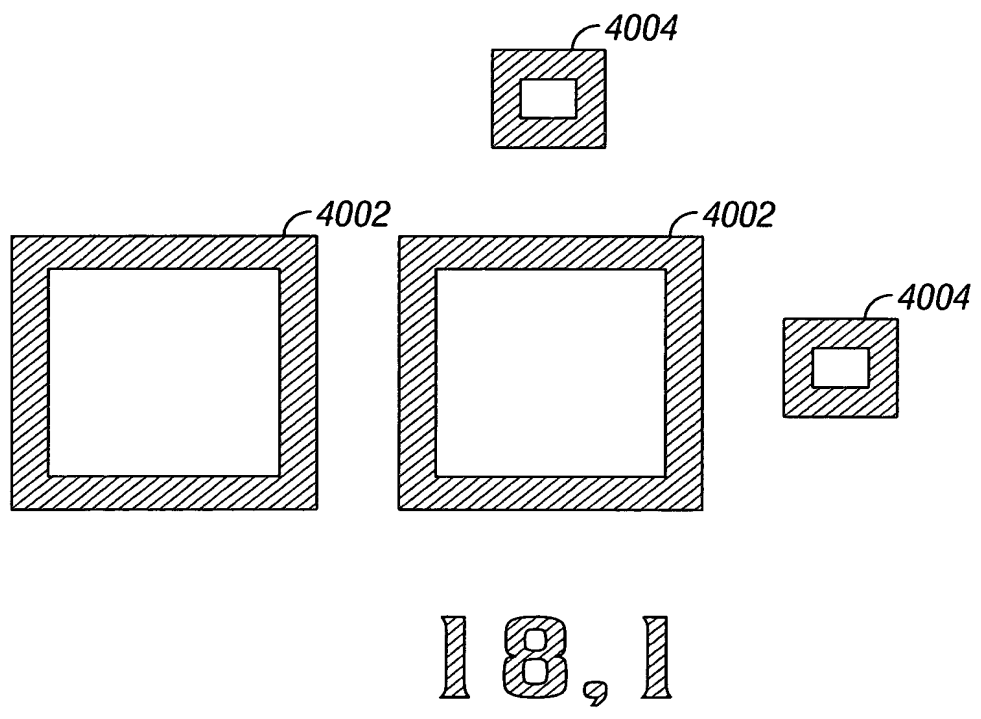


FIG. 40

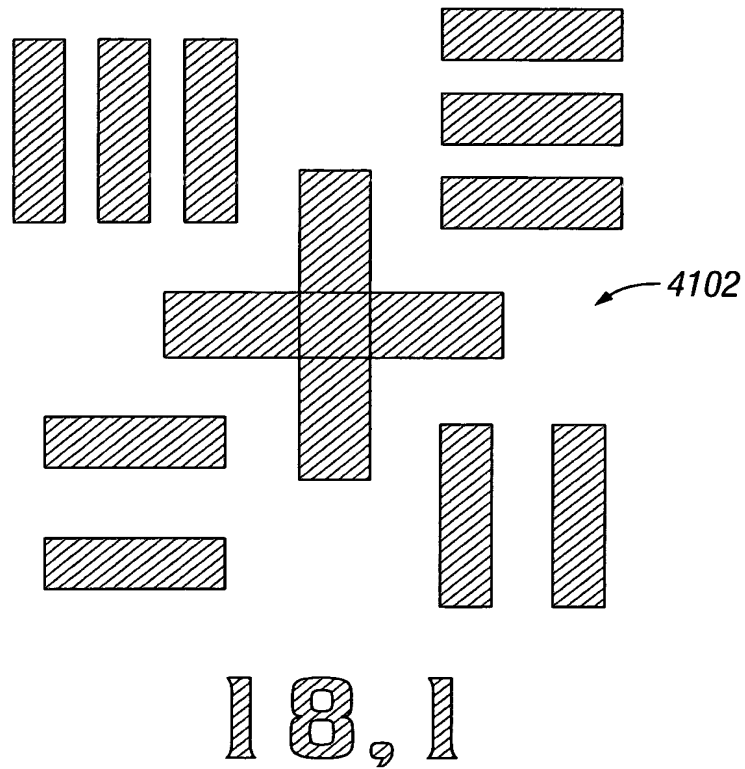


FIG. 41

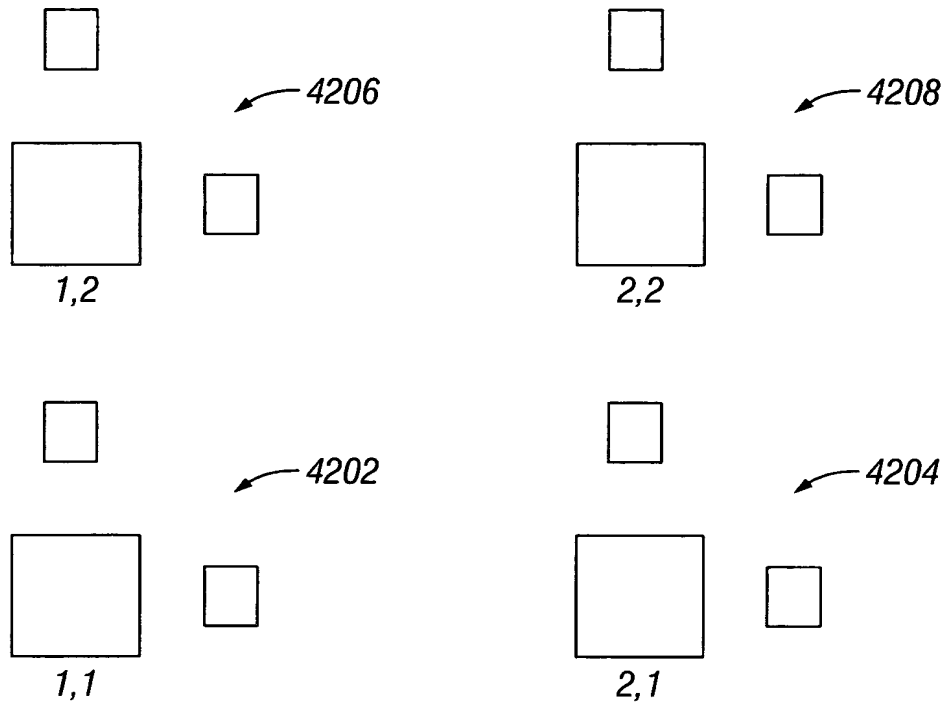


FIG. 42

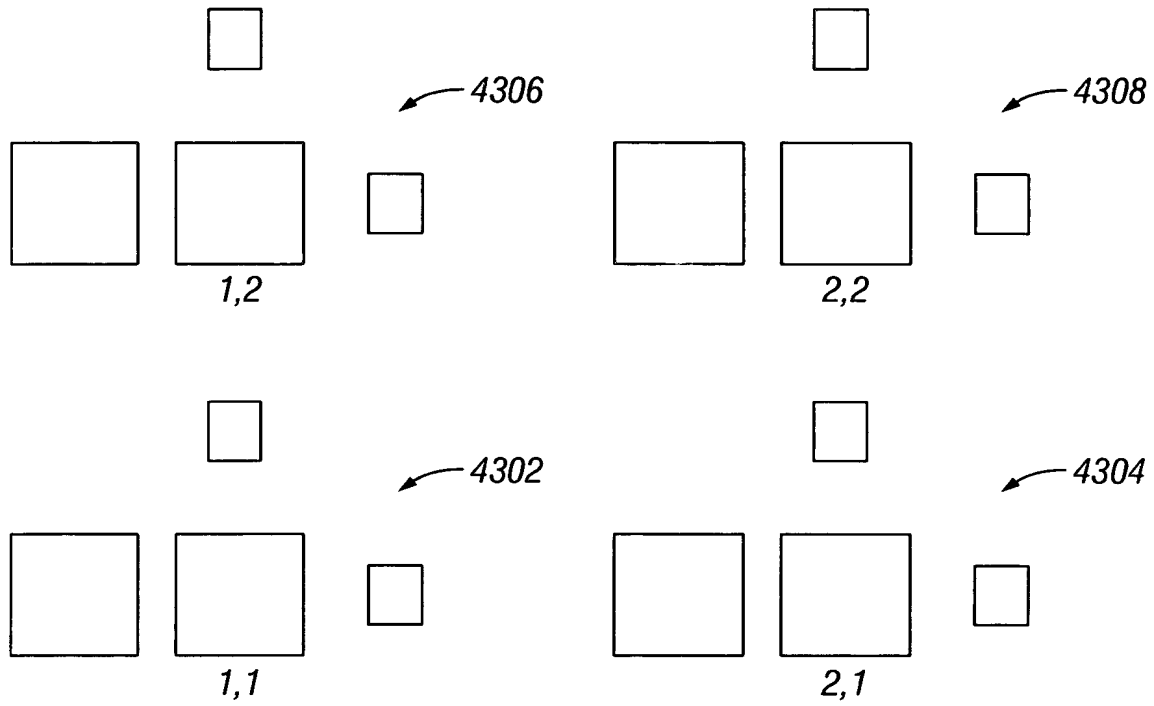


FIG. 43

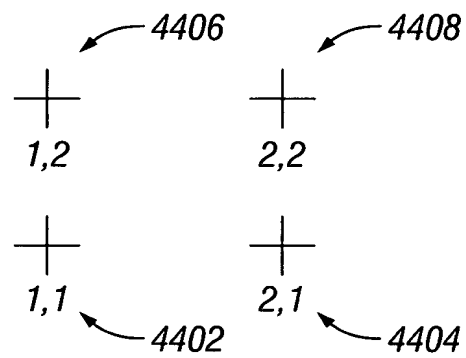


FIG. 44

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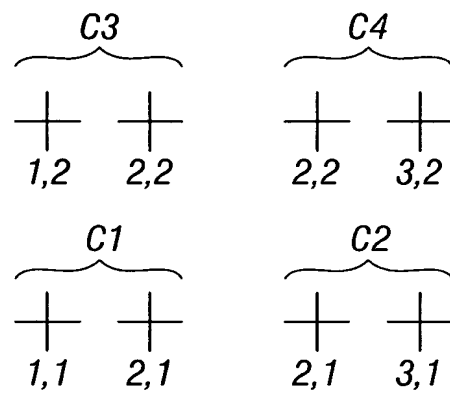


FIG. 45

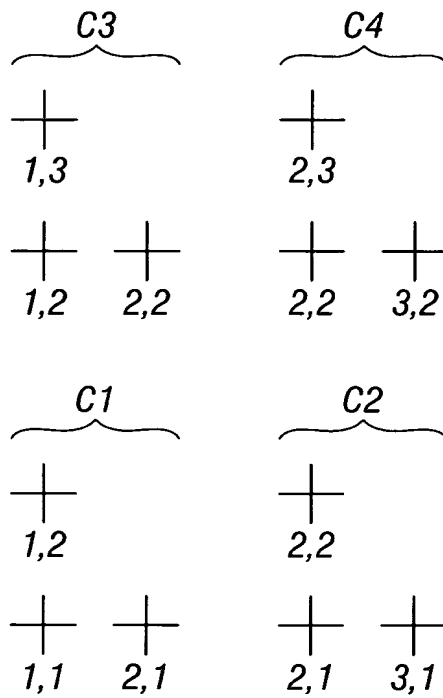


FIG. 46

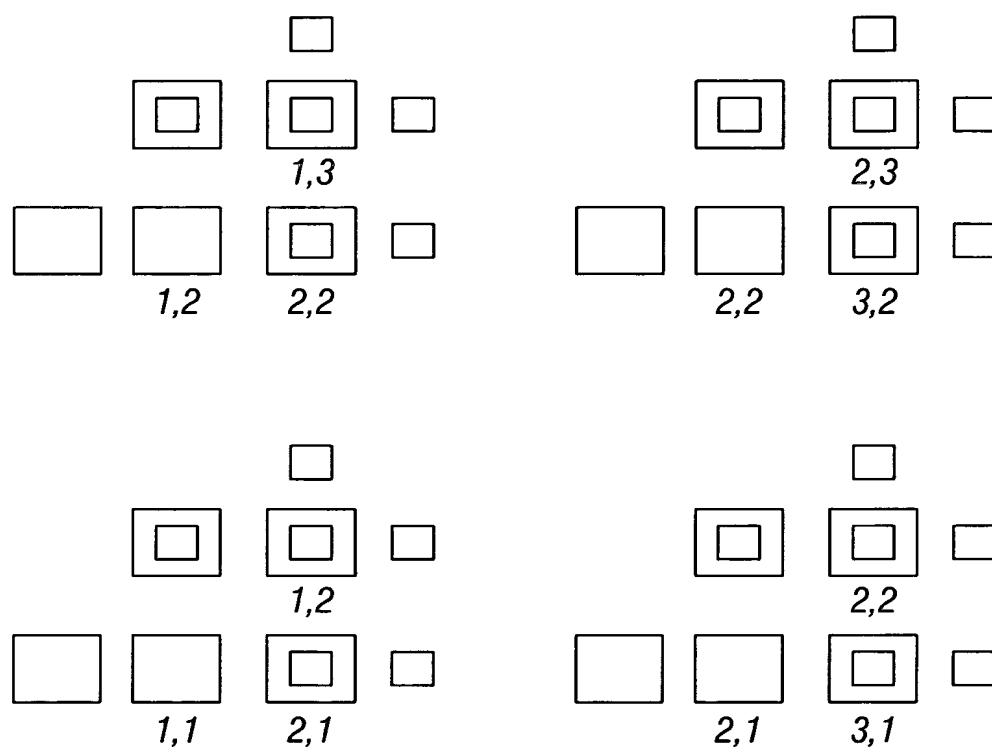


FIG. 47

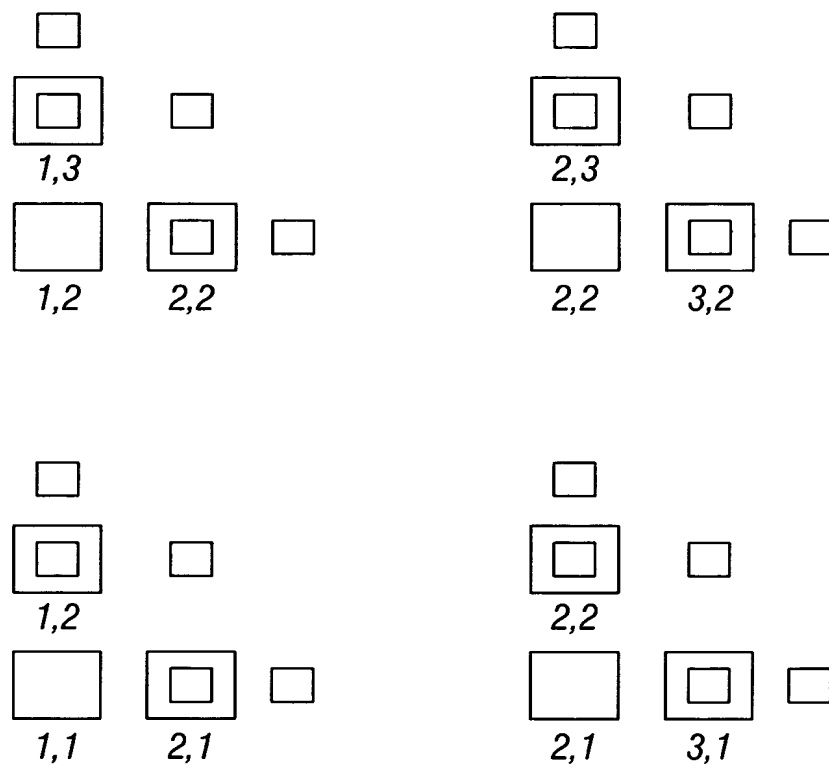


FIG. 48

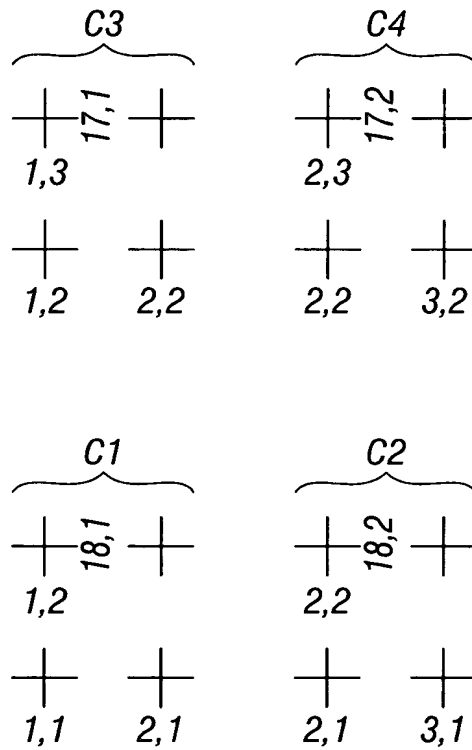


FIG. 49

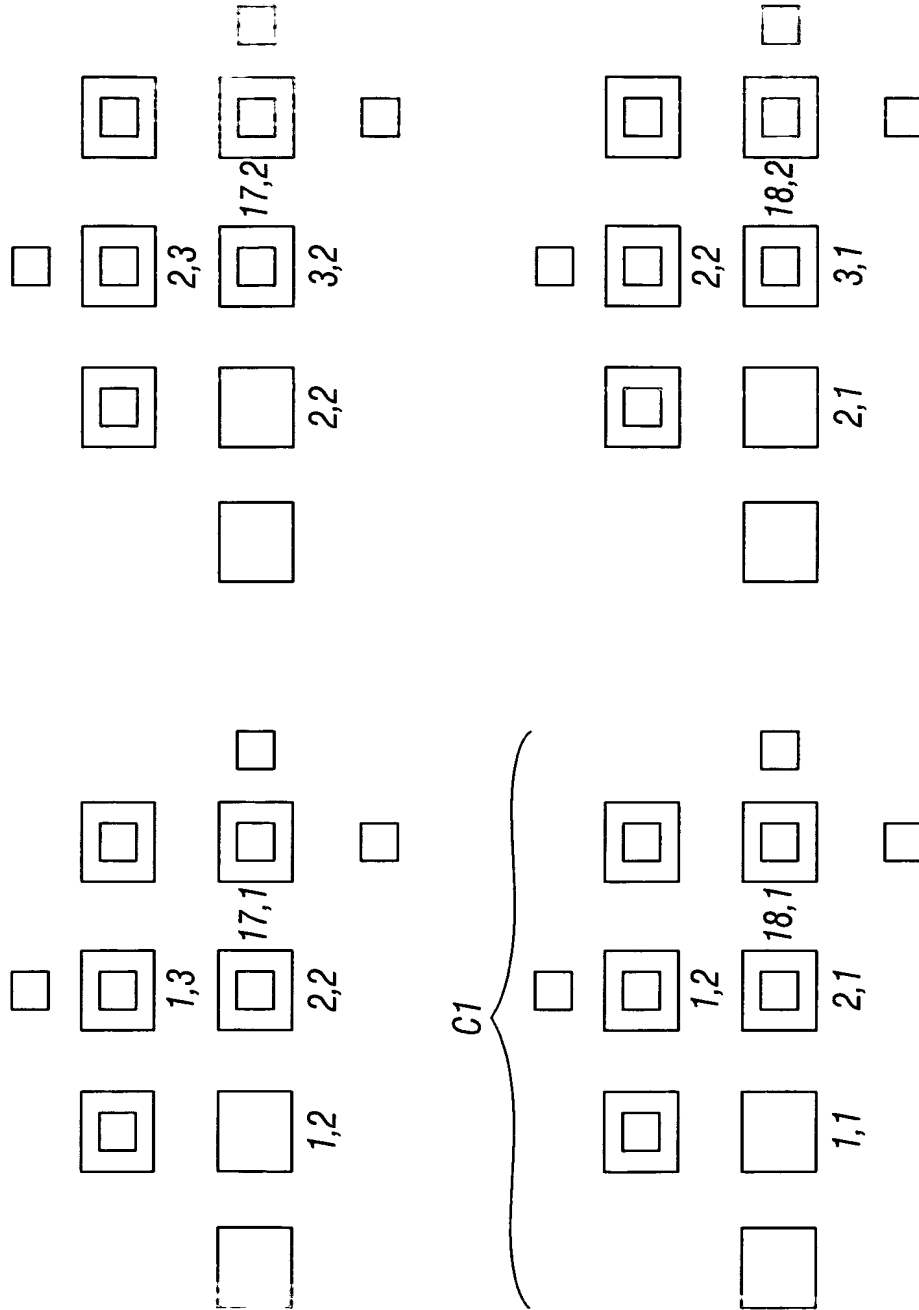


FIG. 50

FINAL RESULT FOR COMPUTATION OF x AND y TILT.
 (x_f, y_f) = INTRA-FIELD LOCATION IN MICRONS
 (a_2, a_3) = (x, y) TILT IN RADIANS

Machine id: DUVF11-03			
x_f	y_f	a_2	a_3
-10000	-10000	-0.15	0.06
-8000	-10000	-0.17	-0.42
-6000	-10000	-0.38	-0.01
⋮	⋮		
⋮	⋮		
10000	10000	0.11	-0.08

FIG. 51